
Course Description and Aims

This short course has the aim to present the current understanding and state-of-the-art of atomization fundamentals, their realization in atomizer systems and their application in a wide variety of engineering branches, including spray drying, spray coating, spray cooling, fuel injection, etc.

These aspects are first addressed theoretically in terms of hydrodynamic instabilities of liquid jets and sheets – primary atomization. This is followed by considerations about the break-up of single droplets – secondary atomization. Engineering solutions for realizing the different atomization mechanisms are then presented.

The second day is devoted to experimental descriptors and diagnostics of sprays and droplets. Both non-optical and optical techniques are addressed. Focus is placed on drop size and velocity determination, but an overview is also given about more advanced techniques, allowing temperature and composition to be determined.

The third day presents possibilities for simulating atomization and spray processes. Modelling of primary atomization is discussed, as well as transport processes within sprays and spray/wall interactions.

The final day of the course covers a wide variety of applications and how spray systems have been developed and customized to meet specific requirements and constraints.

The program foresees intensive discussions between the participants and the lecturers and also among the participants. The aim is to address on-going development and application problems suggested by the participants. Industrial exhibitors of spray diagnostics will be available on the second day for demonstrations and discussions.

Who should attend?

This course is directed towards practicing engineers and researchers involved in R&D and the application of spray systems. For those with little previous background, the course begins with fundamentals of atomization and proceeds through theoretical, experimental, numerical and application topics.

Venue

*Technische Universität Darmstadt
Lichtwiese Campus – Building L2|06
Alarich-Weiss-Straße 10
64287 Darmstadt, Germany*

Course Fees and Registration

- Industry: 1200 EUR
- Academia: 900 EUR

Course fees are VAT exempt according to article 132 (i) Council Directive 2006/112/EC. Included are all documentation of the lectures, coffee breaks, lunches and a course dinner on the third day. Participation is limited to 40 people.

Registration for this four-day short course can be made online from November 2018 on the course website:

www.tfi.tu-darmstadt.de/as2019

For further information, please refer to the course website or contact Ms. Monika Medina:

medina@tfi.tu-darmstadt.de

Short Course on Atomization and Sprays

25 – 28 February 2019
Technische Universität Darmstadt
Darmstadt, Germany



Offered by the Profile Area Thermo-Fluids & Interfaces
in cooperation with DFG CRC/TRR 75

www.tfi.tu-darmstadt.de

Lecturers

Prof. Dr. Nasser Ashgriz

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr. Dieter Bothe

Institute of Mathematical Modeling and Analysis,
TU Darmstadt

Prof. Dr.-Ing. Günter Brenn

Institute of Fluid Mechanics and Heat Transfer,
TU Graz

Prof. Dr. Sanjeev Chandra

Department of Mechanical and Industrial Engineering,
University of Toronto

Prof. Dr.-Ing. Udo Fritsching

Department Multiphase Flow, Heat- and Mass-Transfer,
Leibniz Institute for Materials Engineering (IWT) Bremen

Dr.-Ing. Philippe Leick

Engineering Combustion System,
Robert Bosch GmbH Stuttgart

Prof. Fabrice Lemoine

Laboratoire d'Energétique et de Mécanique Théorique et Appliquée,
Université de Lorraine, Nancy

Prof. Dr. Ilia V. Roisman

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Eran Sher

Faculty of Aerospace Engineering,
Technion – Israel Institute of Technology

Prof. Dr.-Ing. Peter Stephan

Institute for Technical Thermodynamics,
TU Darmstadt

Prof. Dr.-Ing. Cameron Tropea

Institute for Fluid Mechanics and Aerodynamics,
TU Darmstadt

Prof. Dr.-Ing. Bernhard Weigand

Institute of Aerospace Thermodynamics (ITLR),
University of Stuttgart

Prof. Dr. Alexander L. Yarin

Department of Mechanical and Industrial Engineering,
University of Illinois at Chicago

Monday 25 February 2019

Fundamentals

- 8:30 Registration, Distribution of Lecture Notes
9:00 Welcome, Introductions, Overview (*Tropea*)
9:30 Techniques of Atomization: Overview of
Atomizers and their Applications (*Tropea*)
10:30 Coffee
11:00 Stability Analysis of Liquid Jets and Sheets
(*Brenn*)
12:15 Lunch
13:15 Fundamentals of Atomization (*Roisman*)
14:00 Breakup and Atomization Models (*Ashgriz*)
15:15 Coffee
15:45 Secondary Atomization (*Roisman*)
16:30 Drop-Drop Interactions (*Brenn*)
17:15 **Close of first day with beer and pretzels**
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Tuesday 26 February 2019

Characterization and Diagnostics

- 9:00 Spray Characterization – Quantifiers and
Standards (*Tropea*)
9:45 Imaging Techniques (*Leick*)
10:30 Coffee
11:00 Phase Doppler Techniques (*Tropea*)
12:00 Lunch
13:00 Other Optical Techniques (*Tropea*)
13:45 Measurement of Drop Temperature and
Composition (*Lemoine*)
14:45 Coffee
15:15 Nozzle Designs and their Spray Characteristics
(*Ashgriz*)
16:00 Atomization of Complex Fluids (*Brenn*)
16:45 Flash Boiling Atomization (*Sher*)
17:30 **Close of Second Day**
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*Exhibition of spray diagnostic equipment during lunch and
coffee breaks*

Wednesday 27 February 2019

Modeling and Simulation

- 9:00 Direct Numerical Simulation of Primary Jet
Breakup (*Weigand*)
10:30 Coffee
11:00 A Survey on Numerical Simulation Methods for
Multiphase Flows (*Bothe*)
11:45 Volume-of-Fluid Method for Drop Collision
(*Bothe*)
12:30 Lunch
13:30 Fundamentals of Modelling (*Yarin*)
14:15 Heat and Mass Transfer from Drops:
Fundamentals (*Brenn*)
15:00 Coffee
15:30 Powder Production in Spray Processes
(*Fritsching*)
16:15 Drop Combustion (*Sher*)
17:00 Close of Third Day
19:00 **Short Course Dinner**
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Thursday 28 February 2019

Applications & Advanced Topics

- 9:00 Atomizers for Fuel Injection (*Leick*)
10:00 Drop/Wall Interactions (*Yarin*)
10:45 Coffee
11:15 Spray Painting (*Chandra*)
12:00 Atomization in Forensic and High Power
Applications (*Yarin*)
12:45 Lunch
13:45 Spray Coating (*Chandra*)
14:30 Droplet Impingement Cooling with
Evaporation (*Stephan*)
15:15 Spray Cooling (*Roisman*)
16:00 **Close of Short Course**
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